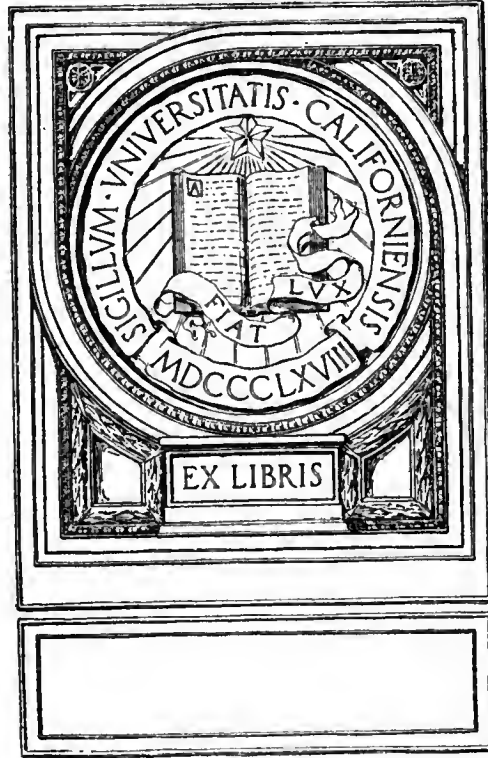




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## A Statistical Consideration of the Number of Men Crippled in War, and Disabled in Industry

In making preparations for the care of invalids of war, some reasonable estimate of the number of men which may be expected to need such care is obviously of great importance. Unfortunately the statistical aspects of this problem are so uncertain that even an estimate becomes a matter of very great difficulty. As was stated by a Canadian Commission in similar connection, "At the present stage of the war it is, of course, impossible to form even an approximate estimate of the number which may ultimately have to be dealt with, depending as it does on the duration of the war and the number of men engaged in hostilities."<sup>1</sup>

The same uncertainty in regard to these two problems in their application to the United States still prevails in 1917, as it did for Canada in 1915.

The best that may be attempted must therefore be a hypothetical answer to a hypothetical question.

Suppose one million men were engaged for a period of one year, how many invalids of war might such a condition be expected to produce?

The answer to this question must depend upon known results of past experiences of warfare. But unfortunately comparatively little is known of the actual number of cripples and invalids produced in past wars, and still less as to the results of the current war. Military statistics of the past dealt largely with the question of killed, died, prisoners, etc., and only gross numbers of wounded without much analysis of the latter. It was impossible to find any reliable statistics or even estimates as to the number of cripples created by previous wars. And even if such data

were available it is questionable how far they would be applicable to the present war, which is being conducted under very much different conditions.

Not only are the numbers engaged so very much larger as to almost destroy any usefulness of comparisons, but the aims as well as methods of actual warfare have changed, and on the other hand the methods of military surgery have been vastly improved.

It has been recognized that the character of wounds in the present war is very much different from that in earlier wars because a very much larger proportion is being caused by shell and shrapnel. Even before an increase in the proportion of losses caused by gun-fire has been noticeable in the history of wars, but the change has been extraordinary in the last war.

The following figures have been taken from a memorandum prepared in February, 1916, by Colonel Hunter of the American War College at Washington, D. C.

PROPORTION OF BATTLE LOSSES CAUSED BY

<i>Army</i>	<i>Rifle</i>	<i>Artillery</i>	<i>All other</i>
Union (1861-1865)	90.1	9.8	.1
Prussian (1870-1871)	91.6	8.4	.6
Japanese (1904-1905)	83.5	13.5	3.0
Russian (1904-1905)	84.5	14.5	1.0

In the Balkan wars the losses from artillery fire were about 20 per cent. In the present war, according to a statement of General Petain of the French Army they are over 35 per cent. for the French and 45 per cent. for the Germans. In a British hospital 52 per cent. were suffering from gun shot wounds, and 40 per cent. from shrapnel. One French Army Corps which had been engaged in an energetic advance, reported

<sup>1</sup> The provision of employment for members of the Canadian Expeditionary Force on their return to Canada. Plan submitted by the Secretary of Military Hospitals and Convalescent Homes Commission. Ottawa, 1915. p. 22.

the following distribution of the wounded according to cause:

- 70.0 per cent. from shell and shrapnel
- 5.0 per cent. from mines (blowing up trenches)
- 14.0 per cent. from small arms
- 0.5 per cent. from bayonet
- 3.5 per cent. from hand grenades
- 7.0 per cent. from unknown causes

Wounds caused by shells, and especially wounds caused by shrapnel, are very much more destructive, and more frequently productive of permanent effects than those caused by small arm fire or even cold steel.

On the other hand there has been a tremendous improvement in military medicine and surgery which has saved many thousands of lives and limbs. While it is impossible to go here into this question at any length, it may be worth while to quote one significant fact. In the Civil War, the losses on the Union side were 360,128.

Killed	67,058
Died of wounds	43,612
	<hr/> 110,670
Died of disease	224,586
Died of other causes	24,872
	<hr/> 360,128

The number of deaths from disease being more than twice that killed or dying from wounds, while for Germany, for the first two years of the present war, the proportion was as follows:

Killed or died from wounds	735,866
Died from disease	48,534

or only 6.6 per cent.

Of the total number of wounded in the Union forces of the Civil War, 14.6 per cent. died, of the German forces of the War of 1870-1871 11 per cent., of the Japanese forces of the War of 1904-1905, 6.6 per cent., and of the Russian forces 3.7 per cent.<sup>2</sup>

In the present war the proportion of deaths has been further reduced, as the following table<sup>3</sup> for Germany indicates.

<sup>2</sup> See: Battle losses of the campaign in Manchuria. By H. Fisher. *Journal of the Military Service Institution of the U. S.*, Nov. 1914. Vol. 55. No. 192.

<sup>3</sup> See *Military Surgeon*, April, 1917.

#### STATISTICS CONCERNING GERMAN WOUNDED

	<i>Died</i>	<i>Dismissed from service</i>	<i>Returned to duty</i>
August 1914	3.0	12.2	84.8
September 1914	2.7	9.1	88.1
October 1914	2.4	8.7	88.9
November 1914	2.1	10.6	87.3
December 1914	1.7	10.5	87.8
January 1915	1.4	9.9	88.7
February 1915	1.3	10.0	88.6
March 1915	1.6	9.5	88.9
April 1915	1.4	7.4	91.2

It is generally admitted that the results may have been less favorable for some of the allied combatants, at least on the eastern and Asiatic fronts.

As far as the total number of invalids is concerned, this improvement in military surgery may have the somewhat paradoxical result of increasing them by preventing fatal consequences in many injuries which in the past, under less skillful surgery, unavoidably resulted in death.

It is necessary, therefore, to rely upon data of the present war rather than previous wars. For obvious reasons, however, information as to losses during the present war is carefully guarded. Even when the published data are taken at their face value the proportion of invalids still remains a matter of conjecture, and even after some estimate of them is made, the probable proportion depends upon the 'exposure', *i. e.*, the number of soldiers exposed to the war hazard, and as to that, too, definite statistical data are lacking.

In the following pages estimates of expert persons had to be relied upon. Statements as to number of troops engaged and losses sustained appear frequently in the daily press and other publications. Most of these statements emanate from the opponents, losses of the Central Powers being computed by the allied press, and vice versa.

Only one or two such estimates originating from neutral sources will be given here.

An estimate<sup>4</sup> for the first two years of war, made early in 1917 by a Copenhagen society for

<sup>4</sup> Quoted from *North China Herald*, February 10, 1917.

war study was reproduced in a very large number of newspapers throughout the world.

	IN THOUSANDS			
	<i>Died</i>	<i>Wounded</i>	<i>Total</i>	<i>Invalids</i>
<i>Central Powers</i>				
Austria-Hungary	718	1,777	2,495	533
Germany	885	2,116	3,001	635
Bulgaria	25	60	85	18
Turkey	150	350	500	105
	1,778	4,303	6,081	1,291
<i>Allied Powers</i>				
Belgium	50	110	160	33
France	885	2,115	3,000	634
Great Britain	205	512	717	154
Italy	105	245	350	74
Russia	1,498	3,820	5,318	1,146
Serbia	110	140	250	42
	2,853	6,942	9,795	2,083
<i>Grand Total</i>	4,631	11,245	15,876	3,374

The round numbers in which the estimates are given are sufficient indication of the paucity of accurate statistical data.

Unfortunately the data of greatest importance for us here are probably the least trustworthy, namely as to the number of invalids. They seem to indicate that on an average 30 per cent. of the wounded become invalids. The German data above given, as well as estimates from other countries, create a strong presumption of a very much smaller percentage of permanent invalids. Thus it is stated in a military periodical<sup>5</sup> that the British losses in the battle of the Somme amounted to some 4,000 per day, distributed as follows:

Killed or dying of wounds or disease	800	20 per cent.
Prisoners	600	15 per cent.
Wounded (not fatally)	2,600	65 per cent.
Of these returned to duty	2,210	85 per cent.
Permanently disabled	390	15 per cent.

It is probable that the proportion of the wounded who have to be discharged for permanent disability does not exceed 20 per cent. at

<sup>5</sup> *Military Surgeon*, December, 1916.

most; that on the Western Front and for Germany it does not exceed 10 per cent.

An estimate of the losses for the first two years of the war, with the assumption "that in Germany 90 per cent. of the total wounded return to the front, and 80 per cent. in all other countries," made by Col. W. W. Harts of Washington, D. C., was obtained in the Library of the Army War College.

This estimate shows evidence of use made of the data of the Copenhagen society, and yet differs from it in certain cases:

#### PRESENT WAR LOSSES

	<i>Killed</i>	<i>Disabled by wounds</i>	<i>Captured or missing</i>	<i>Total</i>
England	205,400	102,500	107,500	515,400
France	870,000	540,800	400,000	1,810,800
Russia	1,500,000	784,200	800,000	3,084,200
Italy	105,000	49,000	55,000	209,000
Belgium	50,000	22,000	40,000	112,000
Serbia	60,000	28,000	.....	88,000
	2,790,400	1,526,500	1,402,500	5,819,400
Germany	893,200	450,000	245,000	1,588,200
Austria	523,100	355,000	591,000	1,469,100
Turkey	127,000	110,000	70,000	307,000
Bulgaria	7,500	7,000	6,000	20,500
	1,550,800	922,000	912,000	3,384,800
<i>Grand Total</i>	4,341,200	2,448,500	2,314,500	9,204,200

The average loss of life per month of conflict figures at some 180,000 and the average number of invalids at some 100,000 per month.

These averages are obtained by a simple division of the totals by 24. Some of the belligerents, however, had not been participating in the struggle during the entire two-year period, and thus some additional error is introduced which becomes of some moment when an effort is made to correlate the above figures with the number of persons exposed.

To adjust for this error the following table may be constructed:

	Time of Entry into War	Months until August 1, 1916	KILLED		DISABLED BY WOUNDS	
			Total	Per Month	Total	Per Month
Allied Nations						
Great Britain	August 4, 1914	24	205,400	8,558	102,500	4,271
France	August 1, 1914	24	870,000	36,250	540,800	22,533
Russia	August 1, 1914	24	1,500,000	62,500	784,200	32,675
Italy	May 23, 1915	14	105,000	7,500	49,000	3,500
Belgium	August 1, 1914	24	50,000	2,083	22,000	917
Serbia	July 28, 1914	24	60,000	2,500	28,000	1,167
			2,790,400	119,391	1,526,500	63,663
Central Powers						
Germany	August 1, 1914	24	893,200	37,217	450,000	18,750
Austria	July 28, 1914	24	523,100	21,796	355,000	14,792
Turkey	October 29, 1914	21	127,000	6,047	110,000	5,238
Bulgaria	October 13, 1915	9½	7,500	763	7,000	737
			1,550,800	65,823	922,000	39,517
Grand Total			4,341,200	185,214	2,448,500	104,580

Taking therefore all the combatants at war in Europe in the fall of 1916, their average monthly losses seem to equal about 185,000 dead and 105,000 permanently disabled by wounds.

What proportion does that represent of the forces exposed? In other words what was the numerical strength of the fighting armies during these two years? An accurate statistical computation would require such data for every month during these twenty-four months. Of course such data are not available except to the governments engaged in the war. Numerous estimates have, however, appeared, and of these the following prepared by Colonel Harts is quoted. This represents the fighting strength of all the armies towards the close of 1916. (The navy and the armies conducting military operations in various colonies have not been included.)

#### PRESENT STRENGTH OF ARMIES

England	2,600,000
France	2,790,000
Russia	6,500,000
Italy	1,700,000
Belgium	200,000
Serbia	272,000
Rumania	600,000
<i>Total</i>	14,662,000

Germany	4,000,000
Austria	2,500,000
Turkey	690,000
Bulgaria	260,000
<i>Total</i>	7,450,000

According to this estimate the total strength equaled about 22,000,000. Approximately at the same time (December 17, 1916) an estimate was published in the *New York Times* of 18,150,000 men, but this did not include the Asiatic theatres of war.

How far are these estimates representative of the entire course of war? Undoubtedly it took some time to develop the full war strength, especially in the case of some belligerents. This would make the size of the armies an ascending line. On the other hand the accruing losses from fatalities, wounded, prisoners, sick, missing, would tend to make the line a descending one. In absence of better statistical data, it may be permissible to assume as a very rough approximation that the total fighting strength of the belligerents averaged about 20,000,000.

This would lead to the conclusion that the average monthly loss per 1,000,000 men equaled about 9,250 in killed and 5,250 in disabled. The proportion per annum would equal about 111,000 killed and 63,000 permanently disabled. The average number of wounded would be between 400,000 and 500,000.



Assuming a definite estimate as to the total number of persons disabled, what proportion of these would come within the class for which re-educational service is intended? In regard to this problem, some very interesting data have been published by Canadian authorities.<sup>6</sup>

According to the information obtained by this authority, the number of Canadian men discharged from the Army and Navy as disabled through the war, up to April 15, 1915, was 2,977, and this was distributed as follows:

Eyesight Cases	254
Wounds and injuries to leg (necessitating amputation)	215
Wounds and injuries to arm (necessitating amputation)	176
Wounds and injuries to hand (necessitating amputation)	21
Wounds and injuries to leg (not necessitating amputation)	286
Wounds and injuries to arm (not necessitating amputation)	275
Wounds and injuries to hand (not necessitating amputation of complete hand)	235
Wounds and injuries to head	127
Hernia	101
Miscellaneous wounds and injuries	135
Chest complaints (including tuberculosis)	302
Rheumatism	122
Heart disease	284
Epilepsy	47
Nervous diseases	65
Insanity	29
Deafness	134
Frost bite	6
Miscellaneous disabilities	163
<i>Total</i>	<i>2,977</i>

This table may be summarized as follows:

	<i>Number</i>	<i>Per Cent.</i>
Wounds and injuries to extremities, requiring major amputations	412	13.9
Other permanent injuries to extremities	796	26.7
Other injuries and wounds	363	12.2
Eyesight and deafness cases	388	13.0
<i>Total wounds and injuries</i>	<i>1,959</i>	<i>65.8</i>

<sup>6</sup> See: Provision of employment for the members of the Canadian Expeditionary Force on their return to Canada. A plan submitted by the Secretary of the Military Hospitals and Convalescent Homes Commission. p. 23.

Diseases of chest, heart, rheumatism	708	23.8
Nervous diseases	141	4.7
Miscellaneous disabilities	169	5.7
<i>Total diseases</i>	<i>1,018</i>	<i>34.2</i>

In so far as it is possible to draw deductions from these figures of limited size, they seem to lead to two conclusions.

About one-third of the discharges are due to disease and not to injuries or wounds. Since the estimates made above refer only to those disabled by wounds, it seems probable that in addition to some 60,000 permanently disabled by wounds, there may be a substantial number of those seriously disabled by disease, especially tuberculosis, heart disease, rheumatism, and nervous diseases.

Of the 1,959 disabled by wounds and injuries, 1,208, or nearly 62 per cent. are cases of amputation and other injuries of extremities. It is this group that represents the greatest need of industrial re-education. On the basis of earlier estimates made here, this would equal nearly 40,000 men.

As far as it is possible, therefore, to make an estimate at present, the following seems justified.

Given an army of 1,000,000 men operating for a year, some 40,000 men may be expected to be crippled through serious injuries to their extremities and therefore to require special placement facilities or vocational re-education.

Perhaps a further estimate as to the number of leg, arm, and hand cases may be ventured, though always remembering that extreme caution is necessary in accepting these figures.

Amputation of leg	7,100
Amputation of arm	5,800
Amputation of hand	700
Injuries to leg, requiring no amputation	9,500
Injuries to arm, requiring no amputation	9,100
Injuries to hand, requiring partial or no amputation	7,800
	<i>40,000</i>

#### ESTIMATE OF THE NUMBER OF CRIPPLES IN THE UNITED STATES

In the absence of any reliable statistics concerning the number of crippled persons in the

United States, some estimate must be made, and for this purpose some fragmentary data of foreign origin may be utilized, though the conclusions to be derived from these data must be cautiously accepted.

#### THE BIRMINGHAM ENQUIRY

A census of crippled persons<sup>7</sup> was taken in Birmingham, England, in 1910, by a voluntary committee.

Because of this non-official character of the investigation, which had to rely upon information voluntarily furnished, it is highly probable that the results underestimate the actual number of crippled persons in the city, especially as far as persons in better economic circumstances are concerned. In fact the Committee speaks of itself as "appointed to make a register of the cripples among the working classes of Birmingham." The investigation is described as "primarily one into the total number of cripples and their social condition."

One of the main difficulties of a scientific census of cripples is a proper definition. The Birmingham Committee formulated the following definition: "A person whose (muscular) movements are so far restricted by accident or disease as to affect his capacity for self-support."

*Main Results.* The Committee found in Birmingham altogether 1,729 crippled persons, distributed by age and sex, as follows:

	Male	Female	Total
Over 60 years of age	115	88	203
45 to 60 years	168	107	275
30 to 45 years	121	103	224
16 to 30 years	142	157	299
<i>Total, Adults</i>	<i>546</i>	<i>455</i>	<i>1,001</i>
<i>Children, under 16</i>	<i>388</i>	<i>340</i>	<i>728</i>
	<i>934</i>	<i>795</i>	<i>1,729</i>

The estimated population of Birmingham at the time of the census is given as 525,860, which gives the proportion of cripples as 0.3288 of 1 per cent., or a little less than one-third of 1 per cent.

<sup>7</sup> See: City of Birmingham Education Committee. Report of a Special Sub-Committee of Enquiry, concerning physically defective adults and children, presented to the Education Committee, 27th October, 1911. Birmingham, [1911].

If the same proportion held true of the United States, then with a population of 102,017,312 (for Continental United States, without any of its colonial or non-contiguous possessions) the estimated number of cripples would be 335,433, of which adults (over 16 years of age) would number 194,139 (105,894 males, and 88,245 females) and children 141,296.

#### ECONOMIC CAPACITY OF CRIPPLES

For the purpose of estimating the economic capacity of the cripples, the Birmingham Committee created four divisions:

- (A) Able to go to work under ordinary conditions
- (B) Able to attend a central workshop
- (C) Able to do remunerative work at home
- (D) Unable to do any remunerative work

As far as children under 16 are concerned the same classification was applied, but in a conjectural way, as here probabilities of the future, rather than the present status, were to be considered. The children were therefore divided into these four groups, according to what they were 'likely' to be able to do, and an additional group 'E' was provided for cases in which it was "impossible to estimate their future capacity."

	MALE		FEMALE		TOTAL	
	Number	Per cent.	Number	Per cent.	Number	Per cent.
<i>Adults</i>						
A	128	23.5	86	18.9	214	21.4
B	84	15.4	61	13.4	145	14.5
C	30	5.5	81	17.8	111	11.1
D	304	55.6	227	49.9	531	53.1
	<i>546</i>	<i>100.0</i>	<i>455</i>	<i>100.0</i>	<i>1,001</i>	<i>100.0</i>
<i>Children</i>						
A	125	32.2	125	36.8	250	34.3
B	110	28.4	81	23.8	191	26.2
C	22	5.6	20	5.9	42	5.8
D	31	8.0	37	10.9	68	9.3
E	100	25.8	77	22.6	177	24.4
	<i>388</i>	<i>100.0</i>	<i>340</i>	<i>100.0</i>	<i>728</i>	<i>100.0</i>
<i>Total</i>						
A	253	27.1	211	26.5	464	26.8
B	194	20.8	142	17.8	336	19.4
C	52	5.6	101	12.7	153	8.8
D	335	35.8	264	33.2	599	34.7
E	100	10.7	77	9.8	177	10.3
	<i>934</i>	<i>100.0</i>	<i>795</i>	<i>100.0</i>	<i>1,729</i>	<i>100.0</i>

While over one-half of the adult cripples are therefore unable to do any remunerative work, of the crippled children only about 10 per cent. are in such hopeless condition, and of all the cripples perhaps two-thirds, or at least three-fifths, are capable of participating to a greater or lesser degree in the economic life of the country.

Accepting the above estimates for the United States, some 200,000 to 250,000 cripples would be able to do some work, and presumably in a position to profit by special training.

As to the actual condition at the time of the investigation, as far as the adults are concerned, there were:

	<i>Male</i>	<i>Female</i>	<i>Total</i>
Self-supporting	99	77	176
Not self-supporting, but do not require help	86	70	156
Not self-supporting, do not require help at present, but will want help later on	54	90	144
Not self-supporting and require help	95	96	191
Maintained in institutions	212	122	334
	<i>546</i>	<i>455</i>	<i>1,001</i>

It is evident that while 60 to 66 per cent. were capable of some work, only 17.5 per cent. were self-supporting at the time.

While the investigation did not go very exhaustively into the question of causes the following data for 1,549 cases are interesting.

	ADULTS		CHILDREN		TOTAL	
	<i>Number</i>	<i>Per Cent.</i>	<i>Number</i>	<i>Per Cent.</i>	<i>Number</i>	<i>Per Cent.</i>
Tubercular diseases	206	24.9	285	39.5	491	31.1
Infantile paralysis	73	8.8	175	24.3	248	16.0
Rickets	7	0.8	73	10.1	80	5.2
Congenital deformity	47	5.7	71	9.8	118	7.6
Apoplexy and birth palsy	116	14.0	58	8.1	174	11.2
Accidents	133	16.1	25	3.5	158	10.2
Potts disease	246	29.7	34	4.7	280	18.7
	<i>828</i>	<i>100.0</i>	<i>721</i>	<i>100.0</i>	<i>1,549</i>	<i>100.0</i>

Tuberculosis and infantile paralysis constituted therefore the known causes of almost one-half of all the cases, with rickets and congenital deformities as other important factors. There is, however, an important difference when the causes for adults and children are compared. While tuberculosis and infantile paralysis are important in both groups (and are to be found among adults largely as a result of diseases suffered during childhood) other diseases and accidents appear as equally important factors, developing in later life. In fact eliminating the first five groups as almost exclusively or very largely acquired in childhood, there are 379 cases left of which 133, or about 35 per cent., are due to accidents, and 65 per cent. to various diseases of adult life, with rheumatic affections, nervous

affections and venereal diseases predominating as factors.

#### STATISTICS OF CRIPPLED CHILDREN IN THE GERMAN EMPIRE

The most important statistical investigation of cripples is that undertaken by the German government at the initiative of several organizations for the care of cripples in 1906, prepared by Dr. Konrad Biesalski, perhaps the foremost expert in the care of cripples, and published in 1909.<sup>8</sup>

Unfortunately it is altogether limited to children under 16, and fails therefore to give a com-

<sup>8</sup> Konrad Biesalski, *Umfang und Art des jugendlichen Krüppeltums und der Krüppelfürsorge in Deutschland*. Leipzig, 1909.

plete survey of the problem of the crippled in Germany.

With a population of 50,897,000 on December 1, 1905, the total number of cripples under 16 ascertained through the census was 75,183 or 1.48 per 1,000 population. When this proportion is compared with that ascertained for Birmingham (728 crippled children in a population of 525,860 or 1.38 per thousand) the correspondence appears to be remarkable. On the basis of the German census the number of cripples in the United States could be estimated approximately as follows:

Children

$$102,017 \times 1.48 \text{ per cent.} = 150,985$$

Adults

$$150,985 \times 1001 \div 728 = \frac{207,397}{358,382}$$

The main data as to nature of the condition of the 75,183 cripples may be given here:

Pronounced curvature of the spine		9,167
Tuberculosis of bone or joint		11,303
Deformities, congenital		
Upper extremity	576	
Lower extremity	940	
Both, or other deformity	342	
		1,858
Deformities, through injury		
Upper extremity	1,736	
Lower extremity	1,897	
Both, or other deformity	161	
		3,794
Deformities, through disease		
Other than tuberculosis		
Upper extremity	237	
Lower extremity	1,599	
Both, or other deformity	126	
		1,962
Dislocation of joints		
Hip joint, congenital	6,479	
Hip joint, acquired	886	
All other	1,036	
		8,401
Supernumerary fingers, toes		298
Fingers, toes grown together		
Congenital	617	
Acquired	47	
		664
Curvature fingers, toes		
Congenital	187	
Acquired	255	
		442

Rachitis, general		2,367
Pronounced rachitic curvature of member		4,724
Crippled feet		4,658
Infantile paralysis		11,165
Loss of member, congenital		
1 Upper extremity	355	
1 Lower extremity	59	
More than 1	45	
		459
Loss of member, acquired		
1 Upper extremity	166	
1 Lower extremity	459	
More than 1	25	
		650
Loss of part of extremity, congenital		
Hand	421	
Fingers	802	
Foot	339	
Combination	139	
		1,701
Acquired		
Hand	126	
Fingers	1,737	
Foot	215	
Other	32	
		2,110
All other		9,460
<i>Total congenital</i>		24,465
<i>Total acquired</i>		50,718
<i>Total</i>		75,183

Even of the crippled under 16 years, therefore, over two-thirds suffered from conditions acquired either through disease or accident, and not congenital. And of course among the adult cripples, as the Birmingham figures indicate, the proportion of acquired defects is still higher.

Evidence of this somewhat obvious tendency may be had when the results of the German census are analyzed into two groups:

(a) Children under six

(b) Children from six and under sixteen

	CONGENITAL CONDITION		ACQUIRED CONDITION		<i>Total</i>
	<i>Number</i>	<i>Per cent.</i>	<i>Number</i>	<i>Per cent.</i>	
Under 6	6,254	42.1	8,611	57.9	14,865
6 to 16	18,211	30.2	42,107	69.8	60,318
<i>Total</i>	24,465	32.5	50,718	67.5	75,183

## CRIPPLED THROUGH INDUSTRIAL ACCIDENTS

In higher age groups accidental injuries furnish an important factor of permanent injuries. These accidental injuries obtained in civil life may be divided into two groups—industrial and non-industrial injuries. The division is, however, a somewhat artificial one. Perhaps the term used for a time in American literature, but recently discarded, 'work accidents', better expresses the difference. A work accident, or to use the more recent terminology—an industrial injury—is an injury sustained by a worker while at work, and according to the language of some laws, arising out of the employment. A good many other accidental injuries (as for instance those sustained by passengers on railroads) are also due to the industrial activity of the country, but are not technically designated as industrial injuries.

Statistics of accidental injuries are unfortunately as yet in a very unsatisfactory condition in this country. Practically no information of practical value is to be had concerning injuries

of the non-industrial character, except some information concerning railroad accidents, and in some cities, as to street accidents.

Statistics of industrial accidents in general and especially as to accidents to railroad employees and miners have been gathered and published in the United States by State Bureaus for many years, but most of it was very incomplete until very recently. Since 1911 compensation laws have been passed in a very large number of states, such laws being in effect in thirty-six jurisdictions (thirty-two states, territories of Alaska, Hawaii and Porto Rico, and the United States for its own civilian employees), and at the present writing such laws have been enacted in forty-one jurisdictions (thirty-seven states, three territories and United States). Only a few of these states have undertaken the collection and study of accident statistics in connection with the administration of the compensation laws. But a careful study of the available data makes at least some scientific estimate as to the total number of industrial accidents possible for the country as a whole.

California	1915	67,538
Connecticut	November 1, 1914 to December 31, 1915 (14 months)	37,070
Illinois	July 1, 1914 to July 1, 1915	12,240
Iowa	July 1, 1915 to July 1, 1916	31,741
Kansas	1915 to 1916	3,085
Maryland	November 1, 1914 to November 1, 1915	20,348
Michigan	1915	39,781
Massachusetts	1913 to 1914	96,891
Minnesota	July 1, 1915 to July 1, 1916	13,418
Montana	July 1, 1915 to July 1, 1916	6,804
Nevada <sup>a</sup>		1,385
New Jersey	1916	8,611
New York	1915	235,565
Ohio	July 1, 1914 to July 1, 1915	73,541
Pennsylvania	January 1, 1916 to November 1, 1916	67,933
Washington	September 1, 1915 to 1916	19,494
West Virginia		11,415
Wisconsin		11,157
		<hr/> 758,017

Thus the latest statistical returns of eighteen states with a population in 1916 of 53,968,000 indicate 758,000 industrial injuries in one year, which for a total population of 102,017,000

would equal a total of 1,433,000 reported injuries.

But a rough computation like this unfortunately contains a great many sources of error. Not only do states differ as to the proportion of

<sup>a</sup> Average of three years.

the population subject to industrial injuries, but in addition the methods of presenting accident statistics are so different, that little can be learned by the addition of figures of different states. In addition, in many states included in the above tables, certain industries (as, for instance, railroads, agriculture, etc.) are not included under the compensation law—and the reports are therefore far from complete.

The main disturbing factor is, however, the difference in the definition of an 'accident' or 'injury', the slightest scratch being counted in some states, while only accidents calling for money compensation and causing disability of over two weeks' duration are included in others.

In order to make the data at all comparable they have been reduced, as far as possible, to a uniform basis, to what is known in the technical language of accident statistics as a 'tabulatable accident', or an accident causing disability on some other day besides the day of occurrence. Accidents causing no disability beyond perhaps the time required for the dressing, and in any case none beyond the day on which the accident has occurred, have been excluded. For some states it is possible to ascertain the actual figures from the reports, for others these relations may be estimated by the use of the so-called 'Standard Accident Table'.<sup>10</sup>

Furthermore, when the reports include only the more serious accidents of over one week's, or two week's, duration the probable number of 'tabulatable accidents' can be ascertained by means of the same Standard Accident Table.

In the same table are also stated the approximate number of employees covered by the compensation act of the state (according to a computation made by the Bureau of Labor Statistics of the United States Department of Labor (Bulletin 203, p. 66).

The number of fatal accidents which is much more comparable and not subject to some of the above qualifications, is also stated.

	<i>Employees covered by Act</i>	<i>Fatal accidents</i>	<i>Non-fatal accidents</i> <sup>11</sup>	<i>Total</i>
California	611,941	533	46,305	46,838
Iowa	266,936	61	6,471	6,531
Kansas	108,388	57	3,028	3,085
Maryland	188,433	121	20,227	20,348
Massachusetts	1,109,134	509	50,256	50,765
Michigan	597,585	332	39,449	39,781
Minnesota	379,349	195	13,223	13,418
Montana	56,826	136	6,668	6,804
Nevada	24,746	36	1,349	1,385
New Jersey	861,963	308	8,303	8,611
New York <sup>12</sup>	1,748,213	1,079	140,260	141,339
Ohio	1,008,813	482	73,059	73,541
Pennsylvania	2,149,867	2,324	167,676	170,000
Washington	191,458	314	19,180	19,494
West Virginia	203,139	544	10,871	11,415
Wisconsin	401,009	166	17,607	17,773
	9,907,800	7,197	623,932	631,128

Tested by the Standard Accident Table these figures do not appear unreasonable. According to the Table, fatal accidents constitute a little less than 1 per cent. (0.932 per cent.) of all accidents, while for the sixteen states above given the proportion is 1.14, the difference being either due to the omission of many minor accidents from the reports, or perhaps the somewhat more serious character of American industrial injuries.

In the Bulletin of the United States Bureau of Labor Statistics above quoted the following estimates as to the number of employees in compensation and non-compensation states is given (p. 66):

Compensation States (35)	
Employees covered by act	13,307,403
Employees not covered by act	6,264,573
	19,571,976
Non-Compensation States	6,563,700
	26,135,676
Employees of United States	488,711
Interstate Commerce Employees	1,300,000
	27,924,387

<sup>10</sup> Standard Accident Table, by I. M. Rubinow. Spectator Co., 1915.

<sup>11</sup> Loss of time one day and over.

<sup>12</sup> Estimated.

Since a great variety of states is represented in the sixteen for which the above data were given, it may not be unreasonable to assume that the average accident rate for these sixteen states will hold for the country at large.

On this assumption the total number of fatal and non-fatal accidents (on a comparable basis of accidents of at least one day's duration) for the 26,135,676 employees in all the states with or without compensation laws would be:

	<i>Employees</i>	<i>Fatal Accidents</i>	<i>Non-fatal Accidents</i>	<i>Total</i>
16 states as in the preced- ing tables	9,907,800	7,197	623,932	631,129
All states	26,135,676	19,711	1,708,837	1,728,548

To this estimate should be added the number of accidents to the civilian employees of the United States Government and to the railroad employees which are excluded from the accident statistics of all the states.

	<i>Fatal Accidents</i>	<i>Non-fatal Accidents</i>	<i>Total</i>
Industrial popula- tion in general	19,711	1,708,837	1,728,548
U. S. Employees <sup>13</sup>	117	10,759	10,876
Railroad Employees	2,687	160,663	163,350
	22,515	1,880,259	1,902,774

A general estimate of some 22,500 fatal accidents and a total of 1,900,000 seem therefore justified.

For the purposes of this report, however, the essential problem is neither the number of fatal accidents nor the total number of accidental injuries reported, but the number of those which create cripples. Applying the definition which has been used by the Birmingham Committee,

<sup>13</sup> For 1912-1913, when building operations on the Isthmian Canal were almost concluded. In the previous years the number of fatal accidents on the Canal alone fluctuated about 100, and in the entire service about 200 to 230 per annum.

namely, a cripple is "a person whose (muscular) movements are so far restricted by accident or disease as to affect his capacity for self-support," the problem appears identical with that of determining what in the technical language of compensation laws are known as injuries leading to or resulting in 'Permanent Disability'. Such disability may be either total (when earning capacity is altogether destroyed) or partial when the earning capacity has been only reduced but not altogether destroyed, *i. e.*, when the injured person after surgical recovery may still obtain some employment but is unable to earn as much as before, or perhaps his disability is largely expressed in greater difficulty of obtaining employment, as a result of the evidence of his injury.

The large majority of the 2,000,000 industrial injuries, more or less, which occur in this country, naturally does not have such serious results. In fact some 60 per cent. of them lead to complete recovery in less than two weeks, and cause perhaps little more than some pain and discomfort, some loss of wages, and some expense for medical or surgical treatment.

But how many serious injuries with permanent results occur annually in this country as a result of our industrial activity?

If even the bare determination of the total number of accidents, or the number of fatal accidents, requires numerous estimates and computations, the situation is statistically still more complex as far as the number of injuries of any particular description is concerned.

The problem may, however, be approached in two different ways.

*The Standard Accident Table.* As this very problem has become one of considerable importance in the business of compensation insurance, a "Standard Accident Table" was constructed, largely on the basis of European experience which gives the probable distribution of 100,000 accidents according to the nature and gravity of the injury.

Briefly it is assumed, on the basis of this table, that every 100,000 industrial accidents, taking industry by and large, will be distributed approximately as follows:

Fatal cases	932
Total permanent disabilities due to dismemberments	23
Total permanent disabilities due to other causes	110
Partial permanent disabilities due to dismemberments	2,300
Partial permanent disabilities due to other causes	2,442
Temporary disabilities	94,193
	100,000

Injuries resulting in permanent disability, either total or partial in character, may be divided into two large groups:

(a) Dismemberment, or actual loss of some member, or part of member, including loss of eyes.

(b) All other, including loss of use of member, or reduction in functional activity, such as non-united fractures, dislocations, curvatures, contractions, paralysis, weakening of muscles, etc., etc.

The division is of surgical rather than economic importance. But it has acquired also considerable legal importance under American compensation practice for two reasons:

1. Because the great majority of the acts (perhaps some thirty of them) provides different methods of compensation for these two groups of injuries, having schedules of specific benefits for dismemberments, and

2. Because dismemberments are recognizable easily and early, while the other cases of permanent partial disability are not so obvious. The statistical information concerning the latter is therefore much less satisfactory.

Analyzing further the 2,300 dismemberments, which according to the Standard Accident Table may be expected out of every 100,000 accidents.

Loss of arm	159	
Loss of hand	111	
Loss of one leg	129	
Major losses	—	399
Loss of more than one finger		
right hand	256	
Same, left hand	249	
	—	505
Loss of one finger or thumb		
right hand	181	
left hand	160	
	—	341

Loss of one phalanx		
right hand	203	
left hand	274	
	—	477
Loss of toes		57
Loss of one eye		521
		2,300
Total permanent disabilities		
Loss of two legs		3
Loss of both eyes		20
Other causes		110
		133

In this investigation of the problem of cripples it has been agreed to exclude the entire question of blindness, total or partial. The cases of loss of eyes may therefore be disregarded. Furthermore the cases of loss of not more than one phalanx or one finger in the vast majority of cases are not sufficiently important to justify inclusion under the definition of cripple. Thus adjusted, the number of cases per 100,000 accidents which would come under the definition would appear to be

Total permanent disabilities	113
Dismemberments, exclusive of 'eye cases, and exclusive of cases of loss of one phalanx only	1,302
Other cases of permanent partial disability	2,442
	3,857

which equals 3.857 per cent. of the total number of accidents.

In order to apply this method for an estimate of the probable number of permanently disabling accidents in the country, we may either assume this proportion of 3.857 per cent., or apply the proportion of 3,857 such accidents to 932 fatal accidents, which would give a rate of 4.138. In favor of the latter method the argument may be cited that during the early years, accident reporting, many minor accidents remain unreported, and that explains the seemingly higher proportion of fatal accidents in the estimate given for the country as a whole. A conservative procedure would be to assume the mean of the results of the two methods, as the one most likely to approach the actual conditions.



ESTIMATED NUMBER OF PERMANENT DISABILITIES  
PRODUCED ANNUALLY BY INDUSTRIAL  
ACCIDENTS IN THE UNITED STATES

	<i>First Method</i>	<i>Second Method</i>	<i>Mean</i>
Total permanent disabilities	2,150	2,724	2,437
Dismemberments	24,774	31,354	28,064
Other cases	46,466	58,990	52,728
<i>Total</i>	<i>73,390</i>	<i>93,068</i>	<i>83,229</i>

The number of dismemberments (28,064) leading to partial permanent disability may be further analyzed as follows:

Loss of arm	3,425	24,054
Loss of hand	2,393	
Loss of more than one finger	10,886	
Loss of one finger	7,350	
Loss of leg	2,781	4,010
Loss of part of foot, and toes	1,229	
		28,064

How far this estimate is reasonable may be ascertained by combining such statistical data as may be obtained from the numerous publications of various State Accident Boards and Compensation Commissions.

CALIFORNIA

Annual Reports of the Industrial Accident Commission  
1912-1915

	1912	1913	1914	1915	Total 4 yrs.
Fatal	412	583	678	533	2,206
Loss of					
Arm	21	7	28	13	70
Hands	15	10	12	7	44
Two or more fingers	111	90	183	175	559
One finger	202	293	482	422	1,398
Leg	21	15	45	19	100
Foot	12	2		9	23
Toes	13	35	54	40	142
Two or more mem- bers	3		1		4
	398	452	805	685	2,340
Other permanent injuries	61	78	315	404	858
<i>Total</i>	<i>459</i>	<i>540</i>	<i>1,120</i>	<i>1,089</i>	<i>3,198</i>

NOTES. Seeming increase in 1914 due to change from voluntary to compulsory act.

Loss of eye, vision or hearing excepted.

MARYLAND

First Annual Report of the Industrial Accident Commission  
Year November 1, 1914, to October 31, 1915

Fatal	121
Loss of Arm	3
Hand	3
Two or more fingers	49
One finger	130
Leg	3
Toes	4
	192
Other permanent injuries	15
	207

MASSACHUSETTS

Annual Reports of the Industrial Accident Board

	1912-1913	1913-1914	Total
Fatal	474	509	983
Loss of			
One arm or hand	35	40	75
Two or more fingers	133	114	247
One finger	672	804	1,476
One foot—leg	22	24	46
Toes	55	51	106
Two or more members	1	5	6
	918	1,038	1,956

MICHIGAN

Report of the Industrial Accident Board  
1915 and 1916

	1915	1916	Total
Fatal	332	389	721
Loss of Arm	12	17	29
Hand	13	35	48
Two or more fingers	209	342	551
One finger	249	415	664
Part of one finger	363	739	1,102
Leg	14	15	29
Foot	8	13	21
Toes	50	46	96
<i>Total</i>	<i>918</i>	<i>1,622</i>	<i>2,540</i>
Without loss of part of finger	555	883	1,338

## MINNESOTA

Biennial Report of the Department of Labor and Industry  
(Year ending June 30)

	1914-1915	1915-1916	Total
Fatal	129	195	324
Loss of Arm	2	1	3
Hand	3	2	5
More than one finger	59	51	110
One finger	75	63	138
Part of one finger	131	118	249
Leg	3	1	4
Foot or part of foot	7	5	12
Toes	38	14	52
Dismemberments	318	255	573
Dismemberments, without loss of part of one finger	187	137	324
Other permanent injuries	80	192	272
	267	329	596

## MONTANA

First Annual Report of the Industrial Accident Board

	1915-1916
Fatal	136
Loss of Arm	3
Hand	6
Two or more fingers	9
One finger entire	13
One phalanx of one finger	33
Leg	2
Foot	1
Toes	11
	78
Without loss of one phalanx of one finger	45

## NEVADA

Report of the Nevada Industrial Commission, 1914-1916  
(Three years)

Fatal	107
Loss of Arm	2
Hand	3
Two or more fingers	12
One finger	29
One phalanx	25
Leg	2
Foot	3
Toes	7
	83
Other permanent disabilities	128
	211

## NEW YORK

Annual Report of the Industrial Commission for 1915  
(Nine months ending March 31, 1916)

Death	599
Two members	4
Loss of Arm	25
Hand	65
Two or more fingers	291
One finger	444
One phalanx	834
Leg	14
Foot	33
Toes	77
One phalanx of toe	28
	1,815
Excluding loss of one phalanx of finger or toe	862
	953
Other permanent cases	17
	970

## WASHINGTON

Annual Reports of the Industrial Insurance Department

	1911- 1912	1912- 1913	1913- 1914	1914- 1915	Four Years
Fatal	279	371	324	215	1,189
Loss of Arm	8	13	11	5	37
Hand	20	12	6	8	46
Leg	11	20	16	14	61
Foot	2	8	4	5	19
Two fingers or more	108			99	
One finger	281			269	
Toes	29	537	424	21	1,771
Other	2			1	
	461	590	461	422	1,934
Other permanent injuries	226	860	1,020	914	3,020
Total permanent injuries	687	1,450	1,481	1,336	4,954

## WISCONSIN

Industrial Commission Report on Industrial Accidents  
July 1, 1912 to December 31, 1914

Fatal	361
Loss of Arm	23
Hand	15
Leg	14
Foot	10
Two or more fingers	246
One finger	668
Toes	39
Other	4
	1,019

	<i>Period</i>	<i>Fatal</i>	<i>Dis- member- ments</i>	<i>Other</i>	<i>All Per- manent injuries</i>
California	4 years	2,206	2,340	858	3,198
Maryland	1 year	121	192	15	207
Michigan	2 years	721	1,338	?	1,338
Massachusetts	2 years	983	1,956	?	1,956
Minnesota	2 years	324	324	272	596
Montana	1 year	136	45		45
Nevada	3 years	107	83	128	211
New York	9 mos.	599	953	17	970
Washington	4 years	1,189	1,934	3,020	4,954
Wisconsin	2½ yrs.	361	957	?	957
<i>Ten states</i>		6,747	10,122	4,310	14,432

When the available data for ten states are summed up it appears that for 6,745 death cases there were 10,122 cases of dismemberments, or 1.5 cases of dismemberments per 1 case of death. This is only slightly higher than the assumption made earlier ( $1302 : 932 = 1.4$ ) and the difference is undoubtedly due to the impossibility of

excluding minor losses of one phalanx in some states.

As far as the other cases of permanent disability are concerned, American statistical data are as yet practically worthless. In fact this is one of the serious shortcomings of American compensation legislation that these cases are hardly appreciated as yet. In many states *no* cases of permanent disability seem to have been recorded except such as result from actual loss of members—a state of affairs thoroughly contrary to the experience of any one who is familiar with surgical results of accidental injuries. The American data obtainable as yet concerning this group of permanent disabilities are worthless. But as far as the statistics of dismemberments are concerned, the estimate of some 28,000 per annum appears supported by the available statistical material and the total number of industrial injuries when permanent, or at any rate, long term results may be expected, is probably somewhere between seventy and eighty thousand cases per annum.





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